

# Fixpoints vs Moore Families

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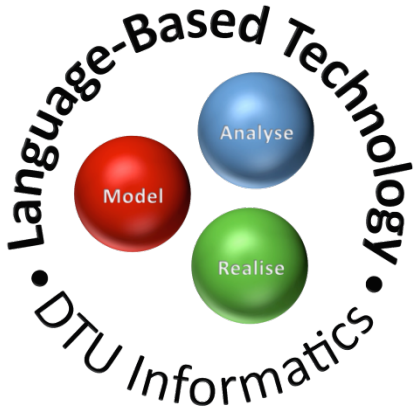


# Fixpoints vs Moore Families

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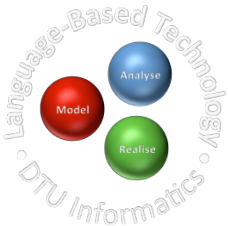


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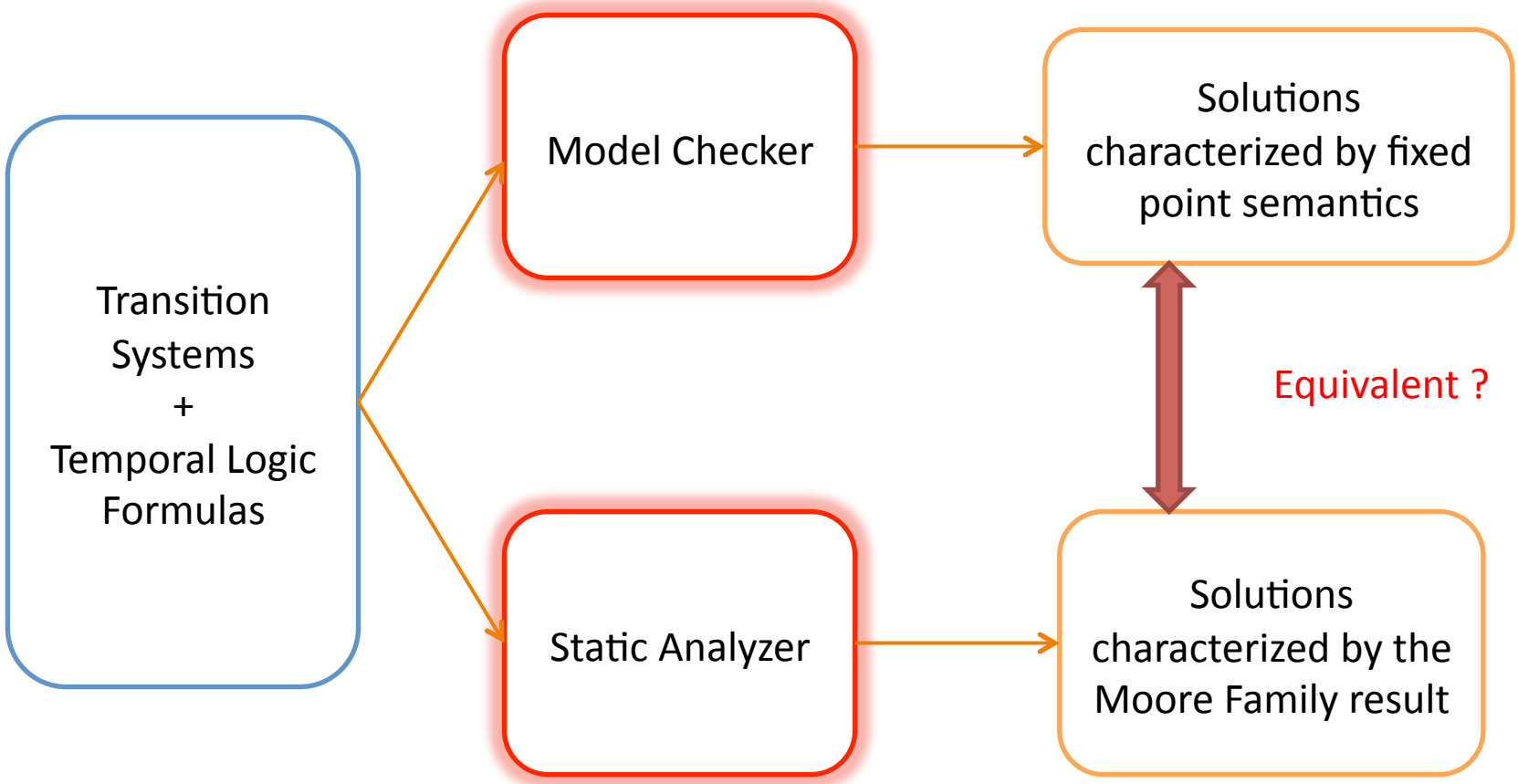
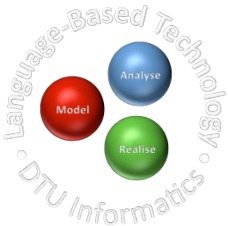
# Model Checking vs Static Analysis

- Static analysis problems can be reduced to model checking.
  - Bernhard Steffen: Data Flow Analysis as Model Checking. *TACS 1991 : 346-365*
  - Bernhard Steffen: Generating Data Flow Analysis Algorithms from Modal Specifications. *Sci. Comput. Program. 21 (2): 115-139 (1993)*
  - David A. Schmidt, Bernhard Steffen: Program Analysis as Model Checking of Abstract Interpretations. *SAS 1998 : 351-380*
  - David A. Schmidt: Data Flow Analysis is Model Checking of Abstract Interpretations. *POPL 1998 : 38-48*

- Model checking can be encoded in static analysis.
  - Flemming Nielson, Hanne Riis Nielson: Model Checking Is Static Analysis of Modal Logic. *FOSSACS 2010 : 191-205*

# Model Checking vs Static Analysis



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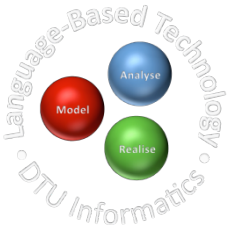
# Model Checking vs Static Analysis

- Model checking for the μ-calculus:
  - The alternation-free fragment of the μ-calculus
  - The μ-calculus formulas of alternation depth n (n>1)

- Alternation-Free Least Fixed Point logic (a logic approach to static analysis)
  - We use *stratification* to deal with negative uses of relations.
  - The Moore Family result: the set of solutions to an ALFP clause constitutes a Moore Family

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# Model Checking vs Static Analysis

- The alternation-free fragment of the μ-calculus can be encoded in ALFP.
  - ➢ The Moore family result makes use of a lexicographic ordering imposed by a suitable choice of ranking of the relations in the ALFP formula.
  - ➢ The set of states of a formula that make it true over a given Kripke structure is described as the least element in a Moore family of acceptable sets of states for the static analysis.

- It's not feasible to encode the μ-calculus formulas of alternation depth n (n>1) into ALFP in a similar way.
  - ➢ It's interesting to identify fragments of the μ-calculus that reside properly between alternation depth 2 and alternation free for which the ALFP-based development might still work.